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Critique

Draft Hot Spot Feasibility Study, New Bedford Harbor

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by

J. G. Hoff

F. X. O'Brien*

S. A. Moss

Southeastern Massachusetts University

* - Deceased, September, 1989

Our comments deal particularly with those portions of the feasibility study that pertain to potential environmental risks associated with the remedial activities considered in it. As a general preamble we note that this feasibility study does not seem to have included much in the way of environmental risk analysis. The few pages devoted specifically to this subject (Section 3.2, pp. 3-14 to 3-20) do not contain detail or, in some cases, references to information to which it alludes. The cited bases for the environmental risk portion of the feasibility study are studies which are seriously flawed. Consequently some of the conclusions reached are illogical or dead wrong.

We also are including comments that relate to other sections of the feasibility study, especially those sections that contain glaring errors or which overlook environmental concerns.

DETAILED COMMENTS

3.2.1 - ECOLOGICAL RISK ASSESSMENT. Methodology

The first paragraph of this section narrows the risk assessment merely to PCBs, ignoring the documented occurrence in the Hot Spot area of extremely high concentrations of toxic heavy metals (Cadmium, Lead, Zinc, Nickel, Chromium, Copper, and Arsenic), the mobilization of which is certain under the favored remedial alternatives. Moreover, the risk assessment fails to deal with toxic organics such as PAHs, which also reside in the sediments that are scheduled to be disturbed.

The second paragraph notes that thirty-three species of "aquatic receptors" have been "identified" in the harbor. These "representative" species are not identified, nor is reference made to documentation concerning them. It is difficult for us to comment in great detail on a risk assessment that does not reveal the organisms on which that assessment was conducted. We doubt that an extensive inventory of living resources in New Bedford Harbor has been compiled. Outside of a seriously flawed benthic study (see below) we are aware of no attempt to compile even a faunal list for the area, let alone population estimates of the organisms living there. New Bedford harbor is frequented by many species of fish, shellfish, benthic invertebrates, and a host of migrating shore birds and waterfowl. It is a particularly favored wintering ground for waterfowl, including Greater Scaup, Redheads, Canvasbacks, Black Ducks, and several species of sea ducks. The degree to which remedial activities will impact these elements of the environment has seemingly not been considered.

The discussion of the "three harbor areas" in the third paragraph of this section suggests that it was written for the larger Environmental Risk Assessment section being prepared for the entire harbor FS. Sediment contaminants in Areas II and III seem to have little relation to the Hot Spot FS.

3.2.2 Results of Environmental Baseline Assessment.

The first paragraph of this section refers to toxicity experiments conducted by Hansen in which amphipods and sheepshead minnows were exposed to sediment from areas I and II of the harbor. Note that the toxicities reported were the result of all of the materials in the sediments, not specifically to PCBs. The use of this information does not seem appropriate to a risk assessment that is confined (3.2.1) to PCBs. Moreover, the species of amphipod (*Ampelisca abdita*) used by Hansen in his experiments was not found by the U.S. Army Corps of Engineers in its benthic study of New Bedford Harbor.

The second paragraph does not specify the "laboratory benchmark concentration" of water column PCBs used in the toxicity quotient analysis. It further states that because these concentrations exceed the chronic AWQC, there is an expected impact to aquatic life. Water column PCB concentrations measured by USACE in area I were found to be between 0.64 and 0.77 ppb. The water treatment criteria of the various remedial scenarios will result in the discharge of water column PCBs of about 1 ppb, raising the PCB levels in the water by as much as 25% during the lifetime of the remedial work. This is in addition to the mobilization of PCBs, heavy metals, and toxic organics due to dredging and handling activities. One can conclude that there will be an enhanced short term impact to aquatic life as one result of the remedial activities.

The first sentence of the third paragraph is misleading. It suggests that both Capuzzo and Black worked with reproduction of winter flounder. Capuzzo's study pertained to blue mussels, not winter flounder. Moreover, both of these references are unpublished results that have not passed peer review. Both studies are correlational and did not isolate PCBs as the only factor capable of producing the results which they report.

The fourth paragraph concatenates the conjecture* of the preceding ones with the results of a benthic study of New Bedford Harbor and its analysis carried out under the aegis of the U.S. Army Corps of Engineers. This benthic study is so flawed, and yet so important (it seems to be the only faunal inventory available of the upper estuary) that detailed criticism of it is in order.

USACE Study of the Infaunal Community of New Bedford Harbor

This study is divided into two parts. The first is a report of the sampling methodology, the list of stations, the laboratory analysis methodology, and the raw data that were amassed by the contracting organizations (Sanford Ecological Services, Inc, HMM Associates, Inc, and Cove Corporation).

* - The first sentence in this paragraph, "Based on evaluations of species-specific effects due to PCB contamination, ...", is conjecture. As noted before, the reported effects on amphipods, blue mussels, and sheepshead minnows were due to exposure to sediments and/or water that contained a spectrum of known toxic chemicals--not just PCBs.

The second part (authored by Russell J. Bellmer of USACE) is an analysis of the data reported in part one, including a statistical treatment of community structure.

The sampling methodology used in the collection of benthic invertebrates appears to be so seriously flawed that the subsequent analysis and conclusions drawn are probably incorrect. Although this was not stated in the original Sanford Associates document, Bellmer notes (on page 5) in his report that benthic samples were taken in the outer and inner harbors (Areas II & III, Stations 5 to 26) with a 0.1 m^2 Smith-McIntyre grab. He reports that bottom samples in the upper harbor (Area I, Stations 1 to 4) were taken with a much smaller dredge, a 0.04 m^2 Van Veen grab.* The latter device samples an area of the benthos 2.5 times less than the 0.1 m^2 grab used in areas II and III. It also bites less deeply than the larger grab, removing even proportionately less sediment. Because the number of infaunal species and individuals captured in any benthic study will be a function of the surface area and volume of the sediment sampled, the raw data from different sampling methodologies are usually adjusted

* - Judging from the dates of the collections, the sequence in which the samples were taken, and the missing station location data (loran coordinates, depths, etc) for Stations 1 - 4, it is reasonably clear that the following scenario occurred. The collecting vessel used in Areas II and III was fairly substantial, being equipped with Loran and probably a winch from which the benthic dredge was cast. This vessel, however, could not operate in the shallower water above the Coggeshall Street bridge. The collecting technicians then utilized a smaller vessel (probably a skiff not equipped with a winch) from which they hand hauled the grab. To make their job easier they resorted to the much smaller 0.04 m^2 grab for these area I samples.

before analysis. That adjustment is normally determined by analyzing samples taken with both methods from the same areas.

There is no indication in the present case that duplicate calibration samples were taken and analyzed. The Sanford Associates report does not even state that different methodologies were used. The raw data show no indication of being adjusted. And Bellmer's analysis clearly uses the raw data of the Sanford Associates report, sans the epifaunal species.

The result of all of this appears to be that each of the lower 22 stations were sampled three times with a 0.1 m^2 device (for a total of 0.3 m^2 bottom surface area sampled per station, with unspecified volume). The numbers of species and individuals collected at these stations are then compared with those collected above the Coggeshall Street bridge found under only 3 x 0.04 = 0.12 m^2 bottom surface area and in a volume of sediment not specified, but much less than in stations 5 - 26. This is akin to comparing apples with peanuts, yet this appears to have occurred.

The methods used here surely grossly underestimated the number of organisms found in the sediments above the Coggeshall Street bridge, and probably also underestimated the number of infaunal species found there as well. This damage would have been minimized to a degree if the data had been appropriately adjusted, or if the analysis had been conducted on density values (animals per square meter). Adjustments in the number of species is more unlikely, because of the failure to calibrate the relative grab performances.

As a first order adjustment of the reported data we have multiplied the number of infaunal individuals reported by Bellmer for stations 1 - 4 by 2.5 (the ratio of the surface areas of the two grabs used). This adjustment is conservative because it does not take the volume differences into account. The results are presented in the following table.

Station	Indivd# (raw)	Indivd# (adjusted)	PCB conc
1	108*	2720	8370.00
2	557	1393	79.80
3	1200	3000	22.40
4	1831	4578	2.42
5	866	866	5.30
6	1455	1455	29.00
7	596	596	0.30
8	842	842	3.60
9	844	844	0.01
10	1360	1360	6.80
11	1294	1294	0.00
12	161	161	4.70
13	654	654	1.10
14	495	495	6.90
etc			

* - Bellmer reports this value as 108, but examination of the data clearly shows this to be a typographical error. The actual value is 1088.

Because measures of community structure involve both the numbers of individuals and the numbers of species in a community, the failure here to sample the number of species as well as the numbers of individuals adequately renders Bellmer's analysis of community structure meaningless. About the only valid relationship appears to be that PCB concentrations correlate positively with numbers of organisms living in the sediments.

In our view this attempt to describe the benthic community of New Bedford Harbor is also flawed in a number of other ways. The sample size is over twice as great in areas II and III as in area I, yet species diversity analyses treat the data as if the sample sizes were the same in both regions. When data are segmented into taxa by numbers of species (pp 9 - 10), the taxa are not at the same level (e.g. phyla, class and subclass are all employed). Why would one calculate a variance of 60,653 (p. 10)? And, what does a variance 47 times greater than the range indicate? These questions are important because this is the benchmark study of the existing fauna.

Infaunal communities are responsive to physical and chemical features of their environments such as sediment type and structure and salinities in ways that have not been evaluated here. Indeed salinity was not even measured in this study.

There are indications that taxonomic identifications may have been amiss. For example *Havelockia scabra* (reported here) is a rare, deep water holothuran (10-1200 m) and has never been reported before from Buzzards Bay or adjacent waters. It was probably confused with *Sclerodactyla briareus* (= *Thyone*). *Odostomia seminuda* does not seem to have been recognized as an epizooite living commonly with *Crepidula* fornicata. Its abundance correlates highly with its host. These kinds of simple errors suggest that the more difficult kinds of taxonomic decisions (of which there are plenty in this fauna) may also contain errors.

3.2.2 (cont)

For all of the reasons noted above, the statement in paragraph 4 of this section that says, "A study of benthic populations in the harbor indicated impaired community structure in the upper estuary (USACE, 1986)," remains an assertion that is not scientifically substantiated by the cited study.

3.2.3 Ecological Risks Associated with the Hot Spot Area

The statement in paragraph 2, "Due to the extreme contamination present in Hot Spot surface sediment, benthic and demersal organisms are effectively precluded from living in the area", is clearly wrong. As we noted above, the USACE benthic study showed the Hot Spot region (their station 1) to have one of the highest densities of living organisms in the entire harbor. With this objection in place, the following sentence ("This loss of habitat is potentially significant...") in the same paragraph is meaningless. There has been no loss of habitat due to contamination of Hot Spot sediments.

The first sentence of the second paragraph ("Ecological risks due to transport of PCBs from the Hot Spot sediment are a function [sic] of the amount of sediment exposed and the extent of contamination in the sediment") is a sweepingly simplistic one. On one hand all of the factors affecting transport are involved. These include: the time of sediment exposure to water in an intertidal situation, the diffusion gradient, and weather conditions. The ecological risks are also functions of the receptor organisms available to be exposed to toxic elements mobilized from the sediments (including heavy metals),--and the biological inventory of this entire estuary has not yet been well categorized.

The concluding paragraph of this section argues that the Hot Spot region "dominates contamination" in the area and is thus the most important variable to control. This thinking is couched only in terms of PCB assessment. Heavy metals are probably more toxic and present greater threats to the environment than PCBs. While the hot spot sediments are high in toxic heavy metals, they are not the richest source of these contaminants in the estuary. By the logic expressed in this paragraph, the sediment richest in heavy metals (and PAHs) is "the most important variable to control with respect to environmental risk in the New Bedford Harbor system."

COMMENTS PERTAINING TO SECTIONS OF THE DRAFT FS OUTSIDE OF THE ENVIRONMENTAL RISK ASSESSMENT SECTION

Section 2.2.1, p. 2-11. In the second paragraph PAH contamination is dismissed because of "relatively low levels" and reference is made to detail in Section 3.0. Yet PAH contamination is not considered in Section 3.0.

Section 2.2.2, p. 2-20. There are difficulties with the statement, "There are public health and environmental risks associated with these (heavy) metals....; however, they comprise a small component of the total risk when combined with risks associated with the sediment PCB contamination." First of all the area of the harbor grossly contaminated with these pollutants is far more extensive than that for PCBs. Secondly, they are far more toxic to fish and waterfowl (and humans) than are PCBs. The failure of the remedial program to deal with them in an honest and straight forward manner is curious to say the least.

Section 5.3 (Pilot Study). Apparently the mobilization of heavy metals and PAHs was not addressed during the pilot study.

COMMENTS ON REMEDIAL ALTERNATIVES

The favored remedial alternatives call for substantial dredging. One consequence of this activity that seems not to have been considered is aeration of the disturbed sediments that remain in situ. This will have the effect of disturbing the microbial population of the sediments, particularly with regard to obligate anaerobic forms. Because this group of organisms contains bacteria that currently are metabolizing PCBs, the rate of naturally occurring PCB degradation may be reduced as a consequence of dredging.

The remedial measures favored by this draft feasibility study (incineration of sediments or their solvent extraction) carry some liabilities that do not seem to be addressed in this report. Both scenarios involve the treatment of approximately 640,000 gallons of water per day to remove dissolved PCBs to an effluent concentration of 1 ppb, as well as all suspended solids. The technology to accomplish this, however, seems not to have been well worked out. Neither the flocculating systems nor filter systems tested during the pilot study came close to meeting criteria. Accordingly, the Feasibility Study talks about testing additional flocculants (such as lime, alum, and ferric chloride), and relying on "micro filters" to treat the discharge water, or alternatively, treatment with UV/peroxides. The latter choice would raise serious concerns about introducing toxic peroxide residues into the environment. Introduction of exotic flocculants could produce additional environmental risks. The efficacy of the water treatment with respect to the control of heavy metals or of toxic organics, such as PAHs, seems not to have been considered.

The discharge criterion of 1 ppb PCB after water treatment will raise the dissolved PCB fraction in the water column estuarine water column (ambient levels reported in the Feasibility study ranged from .64 to .77 ppb.). One effect, therefore, of the water treatment will be to increase the flux of PCBs downstream during the lifetime of the water treatment.

To reach the criteria of 0 mg/liter of suspended solids in the wastewater effluent, about 151 mg/liter of solids will have to be removed by flocculation and filtration (151mg/liter is the total suspended solids remaining from hot spot sediment after 24 hours of settling in the CDF). This means that about 800 pounds of solids will have to be removed from the wastewater stream each day. Because this material will be classed as toxic waste, both it, the filter material trapping it, and the flocculants added to it will have to be disposed of by the chosen technology. This disposal of the filter material and the filtrate seems not to have been considered by the designers of the system. It does not appear in the flow charts, nor in the cost estimates.

We believe that the incineration remedial plan seriously underestimates the concentration of heavy metals in the post-incineration ash. On page 7-26 the statement is made that incineration will produce "ash, which will contain metals at concentrations near those observed in the untreated sediment." Yet the incineration process will remove all water as well as the 10 percent organic constituent. Assuming an initial sediment water concentration of 30 to 60 percent (with the fine grain hot spot sediments closer to the higher value, the resulting ash will be about half that of the sediments dredged (this is confirmed on page 7-27, paragraph 2). Assuming that incineration will not volatilize the heavy metals, it is likely, therefore, that the concentrations of these toxics will be doubled in the ash. Given the inexplicit technology for immobilizing heavy metals in solidified ash, the long term containment of these highly toxic compounds seems to us uncertain.

At this level of study the remedial plan for solvent extraction of PCBs appears fraught with environmental dangers. Not only will the residue contain the original levels of toxic metals, but an unspecified amount of extraction solvent will be lost to the environment. No information is given in the feasibility study about the environmental risks associated with the solvent of choice (triethylamine) except to note that it is toxic to aquatic organisms.

GENERAL COMMENTS

Given the obvious risks, uncertainties, and costs associated with the proposed favored remedial plans, it seems appropriate to comment that containment of the Hot Spot sediments seems a safer, more feasible, more sensible remedial strategy than either incineration or solvent extraction. By enclosing the existing sediments with sheet pile, capping with a synthetic liner appropriately covered with sand and soil, a permanent, controllable immobilization of both PCBs and heavy metals can be achieved with a minimum of environmental disturbance. Although 5 to 10 acres of intertidal flat would be converted to upland by this plan, the esthetics would be improved and a productive ecosystem would soon establish itself on the new upland. The "political" objections to this plan could be overcome if community education to the realities of incineration and solvent extraction were included as a "cost" in its analysis.